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THE LOCUST INVASION OF 1889—92.

IN the early part of 1891 a report was issued on the subject of the migratory locust *Acriidium peregrinum* Oliv. Contents. which has recently invaded India. This re-

port gave a summary of the information obtained up to the beginning of December 1890. The notes since collected on the subject of the invasion of Northern Africa, Persia and Turkish Arabia by the same insect, appeared in Vol. III, No. 1, of these *Notes*, where details are also given of what has been ascertained on the subject of the parasites and natural enemies which attack it in India. In the present report it is proposed to give a short sketch of the general features of the invasion in India, together with such fresh information as has been obtained on the subject of the habits of the insect and the methods adopted for dealing with it.

The locusts were first noticed in June 1889, when flights were reported from Sind and Western Rajputana. These flights no doubt originated in the sand-hills of the desert, where the insect is said to breed each year in larger or smaller numbers. They began laying their eggs as usual in June, when the rains of the south-west monsoon broke. During the remainder of the rainy season of 1889 the flights gradually spread throughout Eastern Rajputana, the Punjab, and Sind, egg-laying going on at intervals in various parts of Rajputana and the Punjab. The young locusts which were born from the eggs laid in the beginning of the rains, acquired wings towards the latter part of August. In the beginning of the cold weather, owing to the extensive breeding which had taken place, the locusts seem to have become very numerous in Rajputana and the Punjab, and in November and December flights from these areas found their way throughout the North-West Provinces and Central India, and penetrated even as far as the Vizagapatam, Kistna and Godavari Districts in the Madras Presidency. They were also reported from British Baluchistan. During January and February 1890 stray flights were reported from various parts of India, but the cold seems to have told upon them, and they were not very active. As the hot weather of 1890 approached, however, and the soil, moistened by the winter rain, began to grow warm, the locusts again became active and commenced egg-laying. Eggs were laid throughout the north-western districts of the Punjab in March; also in the Shikarpur District of Sind in April. By June the young locusts hatched from these eggs had acquired wings, and the flights spread in all directions. They penetrated throughout the

whole of the North-West Provinces, besides overrunning Sind and Rajputana, and making their way into Kathiawar. Eggs were laid towards the latter part of June 1890, when the rains had well started, throughout the whole of Western Rajputana, and in the Gurgaon District of the Punjab. The young locusts hatched out in countless numbers in July, and in the case of Western Rajputana they were reported as doing much damage in August. During August and September the flights that were still wandering about, laid more eggs in parts of the Punjab. About September the young locusts, that had been born in the beginning of the rains, seem to have acquired wings, and from September, on through the cold weather of 1890-91, the flights spread in all directions in the most remarkable manner. They made their way throughout Sind, Punjab and the North-West Provinces. Vast flights also moved through Central India into the Central Provinces, and thence eastwards into Bengal and Assam, southwards through Berar and Hyderabad into the Madras Presidency, and westwards into the Bombay Deccan. The flights did a good deal of injury in the restricted areas where they settled, but the people were so industrious in driving them off their crops, and the birds destroyed such large numbers, that the damage inflicted was small considering the vastness of the invasion. Through December, January and February, flights were still reported from all parts of India, but the cold and damp, combined with the relentless persecution of the birds and the people, had thinned their numbers and reduced them to so miserable a state that they were able to do little or no damage.

In March 1891 some of the locusts obtained from the flight which passed over Calcutta in November 1890 began to lay eggs in their cages in the Indian Museum. About the same time, owing no doubt to the increasing warmth at the close of the winter rains, the flights in the Punjab became more active, and egg-laying took place at first in the north-west of the Punjab and Sind, and afterwards in Baluchistan. In May the young locusts hatched from these eggs became extremely numerous in the Punjab.

The rabi crops were generally too far advanced in growth to be much damaged by them, but the extra rabi and the early sown kharif crops—especially cotton—suffered severely. The grass in some tracts was completely eaten down, and almost every bush and tree was stripped of its leaves. Some idea may be formed of the numbers in which the insects appeared, from the fact that railway trains were said to have often found it difficult to proceed, owing to the rails being made slippery by the crushed bodies of the young locusts. A regular warfare was waged against the insects, under the leadership of the district officials, who organized the people for the purpose of collecting the eggs and

destroying the young locusts systematically. The military also rendered useful service in destroying the swarms that invaded cantonments.

The method that was most generally adopted was that of driving the young locusts into trenches, but the Cyprus screens described in the previous report were also used to a small extent, and useful work was done by driving the young into heaps of straw and bushes which were then set on fire. In this way many thousands of maunds of young locusts were destroyed, and the actual crops were in many places protected. The numbers of the locusts, however, that bred in waste places in the Punjab was so enormous that success was only partial, and vast hordes became full grown and acquired wings. Towards the latter part of May large flights of these young locusts began to pass over Central India and the North-West Provinces into the Central Provinces and Bengal, at the same time penetrating into Kathiawar. During the months of June, July and August, these flights seem to have flown about from district to district, descending at intervals to devour the young kharif crops and doing a good deal of damage over restricted areas, especially in Bengal. They did not lay any eggs, however, and little was heard of them after August, the supposition being that by this time they had been pretty completely destroyed by the birds and unfavourable climatic condition of the damp regions into which they had penetrated.

The immediate result of the departure of these flights seems to have been to clear the Punjab of locusts, but the insect was still prevalent in Sind and Rajputana, and soon after the commencement of the rains of the south-west monsoon, flights began to be again reported from the Punjab. During the rainy season of 1891, egg-laying went on as usual in Sind and Rajputana, while in the Punjab, eggs were reported in comparatively small numbers, at first from the south-eastern districts, and afterwards throughout the whole area, thus pointing to the supposition that the eggs were laid by flights from Rajputana. Breeding seems to have gone on at intervals throughout the rainy season of 1891, young locusts being still reported in the Punjab Salt Range in November. But they were very much fewer than before, and the birds—especially the Rosy-pastor (*Pastor roseus*)—destroyed them in vast numbers. The locusts themselves also were so much parasitised and diseased that the work of the people in destroying them was very much lightened, and by the close of the year the pest seems to have been pretty completely wiped out.

In March 1892 a few locusts again appeared in Sind and the western frontier of the Punjab, and laid eggs in Dera Ismail Khan, while in May some stray flights penetrated into the North-West Provinces and

Bengal, little damage, however, has been reported, and the insects seem to have been too few to cause any anxiety.

It will be remembered that the only important points in the life

Notes on the life history of history of the insect on which any serious the insects. doubts were indicated in the previous report,

were upon the subject of the number of generation in the year and the relationship borne by the young locusts which hatch out in the spring to those which hatch out in the autumn. An attempt has since been made to settle these points by rearing the insect upon a considerable scale in large cages which were specially constructed for the purpose in the Indian Museum. The cages were placed under somewhat different conditions of sunlight and moisture, but in each case the insects, though reared from the egg to the imago stage without difficulty, died off before any ovipositing took place.

Considerable quantities of eggs were received from Rawalpindi and Peshawar in the spring of 1891. The first sets dried up without hatching, in spite of the attempts that were made to keep them moist by watering the earth in which they were placed (¹). Eggs received in the end of March, however, hatched out freely, though a large proportion are believed to have been destroyed by the parasitic flies that also emerged in large numbers (²). These young locusts were reared through all their stages without difficulty, though there was considerably greater mortality amongst them than had been the case with the ones that were reared in the Museum the previous year, and this in spite of the fact that the rearing cages were larger than before, and were kept, some in the Museum and others in the open air, with a view to testing the conditions most favourable to the development of the insect. The young locusts acquired wings by the middle of May, but died off so rapidly that there was hardly any of them left by the end of the month. It was not possible, therefore, to make any observations as to the time at which they would lay their eggs.

On the 19th June 1891, Captain C. G. Parsons wrote from Kohat, that up to a few days previously locusts had been obtainable in the western portion of the district in every phase of development from eggs to fully-winged insects. He concluded that the process of egg-hatching had continued from the beginning of April until the beginning of June in tracts of country where the difference in elevation caused only a slight change of climate. We have seen that the locusts that were hatched

(¹) This would seem to indicate that breaking up the land to expose the eggs to the air would be useful, provided it were done soon after the eggs were laid. Later on ploughing up the land becomes almost useless as the eggs hatch out whether exposed to the air or not.

(²) Noticed more fully in No. I of this volume, pages 34 and 35.

from the earlier batches of eggs, acquired wings in May, but there is evidence to show that these young locusts were not the parents of the eggs found by Captain Parsons in the middle of June, and probably not of any of the eggs laid during the rains. The flights which overran the North-West Provinces and other parts of India during the rains of 1891 were composed, as we have seen, of the young locusts in question. Large numbers of specimens from these flights were sent to the Museum from various places, but the numerous females that were dissected, invariably had their ovaries far too undeveloped for egg-laying. It is clear, therefore, that these young locusts could not have been the parents of the later broods of eggs. The case of the locusts sent to the Museum from flights which visited Singbham in the end of June and beginning of July, has been recorded as a typical one. The first specimens from this district were received in the Museum on the 30th June. The females were found on dissection to have their ovaries in an altogether rudimentary condition. On 7th July a number of living specimens were forwarded from the same locality. These were carefully fed in a cage in the Museum, and from time to time a specimen was dissected; but up to the 7th of August, when the last specimen died and was dissected, though the growth which had taken place in the ova was very distinctly perceptible, yet there did not appear to be the slightest probability of the insects being ready to oviposit for a long time to come. The impossibility of keeping the locusts in a healthy condition in confinement makes it that deductions drawn from caged specimens must necessarily be unreliable. So far, however, as the evidence can be depended upon, it goes to show that the later broods are not the offspring of the young locusts hatched in the early part of the year. The question would be an easy one to solve for any one who lived on the borders of the deserts of Western Rajputana, where the insect is constantly to be found. All that would be necessary would be to dissect the insects present from day to day, and to trace the growth of the ovaries throughout the year. It may be suggested that the matter is one that might reasonably be taken up by some of the medical officers who are resident in the areas concerned.

With regard to the parentage of the eggs which are so often laid in the Punjab towards the close of the winter rains, it has been ascertained that eggs can be laid at this time by locusts which were themselves hatched in the preceding rains. Winged locusts from a flight which passed over Calcutta in November 1890, and which had almost certainly originated in eggs laid in Rajputana in the previous rains, were kept in a cage in the Museum and regularly fed. In the latter part of March 1891 they began copulating, and on the 26th March a number of eggs were laid. The earth in the cage had been previously saturated with water, in

imitation of the conditions that have been shown to be favourable to egg-laying, but the insects seemed to be too sickly to dig holes in the ground and simply deposited them on the surface. Some of the locusts lived on, after laying their eggs, through a great part of April, but by the 4th of May they were all found to have died, while the eggs they had laid dried up, and came to nothing. Very much the same experience is detailed by Colonel Powlett, Resident, Western Rajputana States, who writes in a report, dated 24th April 1891, received from the Agent to the Governor-General, Rajputana, through the Government of India :—

" At and about Jodhpore most of the young brood of locusts appeared early in August. When this brood got wings in September, I caught some hundreds and put them in cages and had them regularly fed; they died off, and by February there were less than twenty left, but two pairs of these were observed to copulate. On the 24th and 25th February two females laid eggs. They were not healthy masses of eggs, and the females did not succeed in depositing them under the soil placed in the cages, nor have they hatched. But it is evidently difficult to keep locusts healthy in cages, and the oviposits being poor is not wondered at. It would appear, however, to be proved that the common locusts of Northern India can copulate and lay eggs six or seven months after birth, and that in all probability the eggs lately laid in the Punjab were those of insects hatched last August. The locusts which copulated round Jodhpore last July were of a bright yellow; the survivors of their offspring, which were pink when put into the cages in September, were in February a dirty purple colour, and to the best of my recollection that was the colour of the locusts the eggs of which many years ago I helped to destroy during the month of March in the Punjab."

The habitual disappearance of locusts throughout the greater portion of the winter months in North-Western India is explained by the fact that they require little or no food during this period, and probably hibernate in a dormant condition. On 28th February 1891 Mr. J. Cleghorn wrote that locusts had been hibernating without food in a cage kept in his house in Peshin, Baluchistan, since the 15th September 1890, though he had found that similar insects in the summer required to be fed constantly to keep them alive.

There is little to add to what has already been recorded upon the Measures adopted against the locusts. Subject of the methods adopted in fighting the locusts, but it may be useful to notice what was actually done during the year 1891 in carrying on the campaign in different districts. The reports which have been received upon this subject are very fragmentary, but the measures they describe are probably typical of what went on over the greater portion of the areas invaded.(1)

(1) The following notices are mostly taken from a report by the Director of Land Records and Agriculture, Punjab, supplemented by the information collected from crop and other reports sent to the Museum.

In the cold weather of 1890-91 numbers of the winged locusts which swarmed into the Rawalpindi district were killed in the early mornings, when they were numb with cold, by the people; and as the spring of 1891 advanced, a regular campaign was organized throughout the Punjab by the district officials for the destruction of the young locusts.

In Dera Ismail Khan, a naib-tahsildar and kanungo, with six or seven chaprasis under them, were put in charge of each tappa, and lambardars and zaildars were warned to render every assistance in their power. Five hundred rupees were spent in rewards. The wells and water-courses were kept clean to avert epidemic disease, but the people were very apathetic, and little impression was made on the vast swarms which crowded into the district.

In Rawalpindi, the district was divided into circles with an officer in charge of each whose main duty it was to look after the destruction of the locusts and their eggs. All tahsil officials were employed in the work of destruction, and a thousand rupees were spent from district funds. Millions of eggs and young locusts were destroyed, but the impression made was small, as the insects laid their eggs largely in the extensive and sparsely peopled Kala Chitta Range, where it was most difficult to get at them.

In Hazara some four hundred maunds of young locusts were destroyed in April in the Mansahra Tahsil under the direction of the tahsildar.

In Peshawar the villagers were turned out at once whenever young locusts showed themselves, and by the 20th April some ten thousand people were at work. When the rabi harvest began the villagers were dismissed, and five thousand hired labourers were employed until about the 3rd of May, when the barley was half reaped and the ears of wheat were too hard to be attacked by the young locusts. At a low estimate, over eighty millions of young locusts were destroyed, the cost being about eight thousand rupees. The myriads of locusts, however, which poured into the district from independent territory made it impossible to deal at all completely with the invasion.

In Kohat orders were issued to turn out the people when the locusts hatched, and the greatest exertions were made to deal with the pest. In the Kohat station itself, Captain Parsons wrote that the chief invasion lasted about ten days. During this time vast numbers of locusts were destroyed each day, the quantity amounting on one occasion to six hundred maunds. One rupee was paid for each maund weighed. Nearly all the undetained inhabitants of the city laboured, and the troops and the boys of the large High School assisted. The collection of the insects was very simple, as they could be shaken off the trees by thousands into sheets held below. Four men could collect a maund in a very short time. There

were ten weighing stations established, and the district funds were freely drawn upon. According to a crop report published in June 1891 numbers of young locusts in the Hangu Tahsil of Kohat were also destroyed by firing the dwarf palms through which they were crawling, while in the Barak ilqua the destruction is noticed in the same report of some three thousand maunds of young locusts.

In Jhelum the destruction of eggs began early in March. From five hundred to six hundred maunds of eggs were destroyed in one tahsil. At first one anna, and later half-an-anna, a seer was paid for the eggs, while gur and atta were distributed to the people engaged in destroying the young locusts. Some Rs.3,000 was noticed as spent from district funds in the early part of the spring upon the destruction of eggs and young locusts. But the Deputy Commissioner states that the people were inclined to be apathetic, as, from the dimensions of the plague, it seemed hopeless to cope with it.

In Shahpur the Naib-Tahsildar of Khushab was put in special charge and large numbers of young locusts were destroyed, though little real impression was made upon the pest.

In Gujranwala in March many of the winged locusts were killed in the mornings and evenings when they were inactive. Every patwari, lambardar and policeman was made responsible for reporting at the tahsil whenever eggs were laid or young appeared. Land in which eggs had been deposited, if not under crop, was ploughed three or four times so as to expose them. Eggs also were collected in great numbers, the usual plan being to make each house in a village furnish daily a "tind" or well-pot full of eggs.

In Sialkot bands of villagers were organised to kill the young locusts. The methods adopted were, driving them into trenches and burying them, and surrounding them with a circle of men armed with branches, who gradually drove them into straw, which was then burnt.

An interesting account is given by Colonel Lance, the officer commanding at Ferozepur, of the methods adopted in fighting the young locusts which invaded that cantonment in May 1891. Both British and Native troops were employed in the work, and Colonel Lance writes:

"Each corps and detachment was given certain limits within which it was to work and to do its best to destroy any swarms that came within them; corps, however, were employed at other places that were heavily threatened, as required.

"With the exception of one heavy swarm that came on the 17th Bengal Cavalry lines, the swarms came on the south-west corner of the station, and on the south-east and north-east as far as the cemetery, near the Sudder Bazar. In the Commissariat-Transport lines they were in countless numbers, and for days it seemed as if they would succeed in getting into the station from that direction.

"The method principally adopted to destroy the locusts was by burning them with dry grass. When swarming in trees or bushes this seems to be the only effective method. When in open ground it is easy to drive them to lines or clumps of dry grass in which they swarm, and which is lighted when the whole swarm has collected. The objection to this method, however, is the enormous expenditure of grass, even when used economically, as was done when the men became experienced in the work. Large quantities of grass were bought, but the Executive Engineer placed at my disposal a large quantity of old thatch, without which it would have been impossible to have provided the quantity of grass required. Kerosine was tried with the grass. It was used chiefly to burn the locusts out of trees and bushes, but it was found after trial that in most cases the grass was nearly as effective without kerosine, a great deal of which was required to produce any result.

"It was found that grass could be much economised by digging a small trench about a foot deep and a foot wide, filling the bottom with a little grass and laying the same lightly on the earth thrown upon the side opposite to that towards which the locusts were being driven. A little more grass sprinkled round the trench after the swarm had been driven into it, and set fire to, effectively secured the destruction of the swarm with but little expenditure of grass.

"Pits were also dug into which the locusts were driven and then buried. This plan is said to answer well when the insects are small, but when, as in the present case, they are large and active, it was found that they could not be kept in the pits unless they were dug very deep, and even then many succeeded in getting away.

"I had the opportunity of trying the method said to have been used with great success in Cyprus. Low canvas screens were made from condemned tents supplied from the arsenal, and strips of American cloth, over which the locusts cannot crawl were sewn to their upper edge. In front of these screens, which were set up in the path of the locusts, pits were dug, round which an edging of tin was placed, up which the locusts could not crawl. Driven against these screens the locusts either hopped into the pit themselves, or were driven in by men who eventually surrounded them. The advantages of this plan are the extent of ground that is covered, the comparatively few men that are required, and the completeness of the operation, as if the screens are sound and the drive conducted with skill and patience, scarcely any locusts can escape being driven into the pits. The tin rim obviates the necessity of the pits being dug deep, 2 or at most 3 feet being sufficient. The rims used were 4 feet by 2 feet, an edging of $2\frac{1}{2}$ inches of tin on the ground surface round the pit, and the same width on the inside edge of it.

"I regret that I knew of this plan too late to provide sufficient screens for general use. I believe that this system will be found most efficacious, and feel confident that had we been prepared with this apparatus the work of destruction would have been carried on with less trouble, and with better results."

In Jhang, according to a crop report issued in June 1891, twenty thousand maunds of locusts had up to that time been destroyed.

The above comprises all detailed information which has reached the Museum on the subject of what was done in the Punjab in the spring of 1891, but numerous incidental notices have been received of the work of destruction which seems to have gone on systematically in all districts where young locusts hatched out.

With regard to what was done in Sind and Rajputana, where egg-

laying also went on, little fresh information has been obtained, but the people seem as usual to have done what they could in the way of destroying the young locusts by driving them into trenches.

In the case of the measures taken in districts that were only visited by flights, no fresh information has been received, but the system which has proved so successful of driving the insects off the crops, is believed to have been universally adopted by the cultivators.

E. C. COTES,

*Deputy Superintendent,
Indian Museum, Calcutta.*

8th June 1892.

NOTES ON INDIAN APHIDES.

BY G. B. BUCKTON, F.R.S.

But little attention hitherto has been given to the tropical Aphides of the old world. Any addition to our knowledge of the species which inhabit British India doubtless will prove of interest, both as being connected with scientific entomology, and with agricultural economy.

Hitherto these Homoptera have been regarded as chiefly inhabiting the temperate regions of the world, but there are reasons for believing that observation only is needed to prove the existence of diverse species, which control the vegetation which flourishes under the equator.

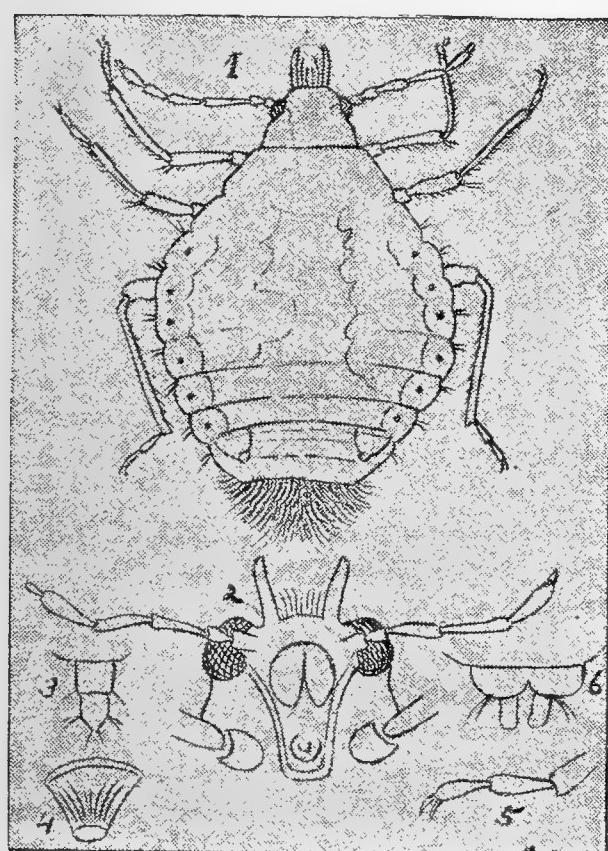
The *Aphis* which attacks the bamboo (*Bambusa arundinacea*) of Dehra Dun, hardly accords with any described European species or even genus. Amongst many hundred specimens sent to me by Mr. Cotes I was unable to find a single winged individual, a circumstance which for the present prevents a complete diagnosis of the species, since the wing venation is of high importance for classical grouping. The characters of the bamboo *Aphis*, however, are sufficiently distinct to justify, in my opinion, the erection of a new genus, notwithstanding that the diagnosis at present can refer only to the apterous viviparous female.

Genus *Oregma* (from ὅργμα to protrude), Buckton. Body globose. Vertex conspicuous from the projection of two straight horn-like processes. Cornicles small and conical. Cauda inconspicuous, often tufted with numerous setæ. Rostrum exceedingly short and rising from between the first coxae.

Oregma bambusæ, Buckton.—Body globose, less so in the immature forms. Corrugated and constricted into segments. Vertex with two cornua. Eyes very small. Notum narrow. Rostrum very difficult to see, rising from the underside of the thorax, much as in *Coccus*. Antennæ about half the length of the body, obscurely five-jointed and ending with a nail-like process, as in *Lachnus*. Legs short. Tarsi with two articulations. Colour greenish brown, more or less mottled with black. Many of the specimens preserved in weak spirit were quite black.

Size 0·070 × 0·050 inch.

Clusters on the upper surfaces of



the bamboo at Dehra, covering the foliage of the plants with its sooty-black excretion, thereby doing some injury.

The winged female and the (apterous?) male are undescribed.

The general appearance of this insect may suggest some affinities both with the genus *Lachnus* and the genus *Chaitophorus*; but the small size of the insect, the short legs, the peculiar front, and the position of the very short rostrum will eliminate it from the first genus, whilst the non-tuberculose and slightly hirsute characters of the abdomen, etc., will separate it from the latter.

An examination of the winged insect will be interesting, and show the group to which this *aphis* should be referred.

Description of the figures—

Fig. 1. Apterous viviparous female.

„ 2. Underside of the head, showing the position of the rostrum between the fore-coxae, the two cornua, and antennæ.

„ 3. The two jointed rostrum.

„ 4. The cornicle.

„ 5. Tarsus.

„ 6. Abdominal apex of immature forms.

A NEW LASIOCAMPID DEFOLIATOR.

By F. MOORE.

Spalyria minor. (¹) n. sp.**Male.**—Upperside very pale ochreous-yellow. *Fore-wing* crossed by a

medial and a discal faintly indicated slender dusky band, both of which are parallel with the outer margin, the outer band being incurved at its anterior end, and the inner band bent inward and slightly waved. *Hind-wing* crossed by two similar slender bands, both parallel with the outer

margin and incurved, inner band slightly waved.

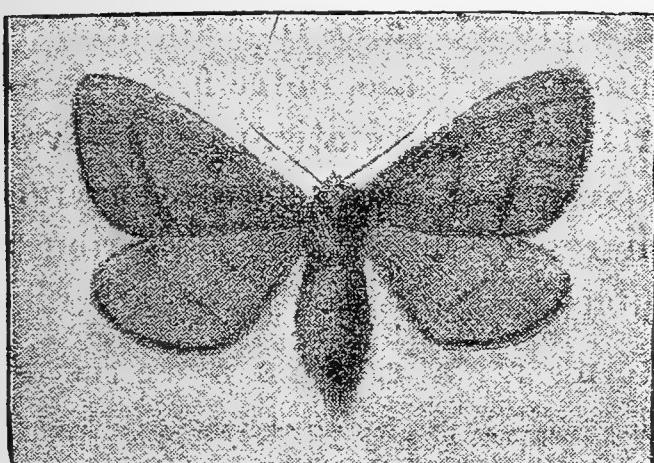
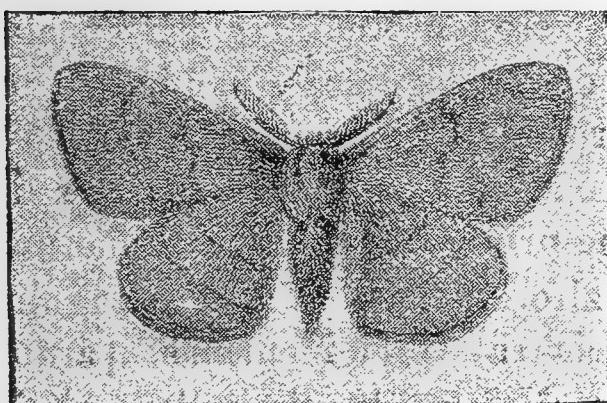
Underside somewhat darker ochreous, both wings crossed by two less apparent slender bands, as on the upperside. Front of head, palpi, and legs above brighter ochreous; pectus brownish ochreous; body above pale ochreous; abdomen beneath a little darker; antennæ pale ochreous; the shaft paler; eyes black.

Female.—Wings longer and narrower than in male. Upperside uniformly purpurescent ochreous-brown. *Fore-wing* crossed by two similar dusky bands, which are somewhat broader and darker than in male, the inner band passing through a darker spot at end of the cell. *Hind-wing* with two similar bands, which are straighter in their course across the wing. Cilia edged with pale cinereous. Body darker purpurescent ochreous-brown; front of head, pectus, and legs brighter coloured. Underside somewhat paler; both wings with the transverse slender bands less apparent. Antennæ dark ochreous-brown.

Expanse—♂ $1\frac{5}{8}$, ♀ $1\frac{3}{4}$ inch.**Habitat**—Burma

Feeds on herbage.

¹ The caterpillars of this insect are said to have proved injurious in Shwebo, Burma. For a note on the subject, see page 20 of No. I of this volume. The types here described consist of a single pair of specimens; of these the male is preserved in the Indian Museum, and the female is to be found in the Phayre Museum, Rangoon—Ed.

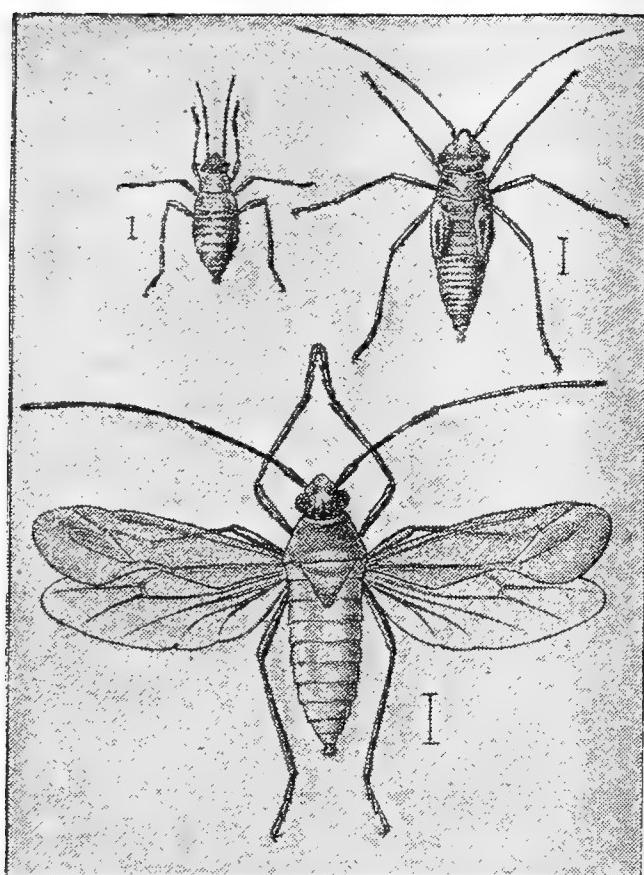


A NEW CAPSID PEST

By Mons. L. LETHIERRY.

Calocoris angustatus ⁽¹⁾ Leth. nov. sp.

Valde elongatus, sordide flavescens : antennis fulvis, articulo primo



sat robusto, longitudini capitis æquali, secundo longissimo, gracili, primo quadruplo longiore, tertio, quarto et quinto æqualibus, gracillimis, longitudine primo æqualibus. Pronotum trapeziforme, punctulatum, angulis posticis sat prominentibus, parum acutis, leviter obtusiusculis, anticis obtusis, margine antico collari distinctissimo, calloso, tertiatâ parte anticâ pronoti callo robusto, lato, in medio emarginato, obtectâ. Hemelytris flavis punctatis, parce fulvopubescentibus, clavo et parte suturali corii roseis, interdum concoloribus : pedibus concoloribus, tibiis spinulis

*nigris dece[n] aut undecim in parte externâ armatis, tarsis apice fuscis.
Long. 6—7 millim.*

Formâ angustatâ congenericis Europœis distinctissimus.

Prov.—Madras.

⁽¹⁾ This insect is noticed on page 27 of No. I of this volume.—It is said to injure cholum (*Sorghum vulgare*) in the South Arcot District of the Madras Presidency—Ed.

THE MANGO SHOOT PSYLLA.

By G. B. BUCKTON, F.R.S.

Psylla cistellata⁽¹⁾ n. sp.

Head small. Eyes globose and prominent. Vertex nearly straight, with a fine vertical suture. Tumid behind the eyes. Antennæ about $\frac{1}{5}$ th the length of the insect, each springing from the face near to the inner margin of the eye. The 4th, 6th, and 7th joint cylindrical, and nearly equal in length. The apical joint terminated by two strong and long setæ. Combined pro-meso-and meta-notum large. Abdomen deeply corrugated and ringed. The dorsal part much raised. Apex of the female terminated by a sharp cauda, composed of genetal plates, saws and rasps, not unlike those seen in the Tettigidæ. The genitalia of the males complex. Legs stout and rather short. Tarsi with two distinct joints terminated by blunt claws and two fine hairs.

Membranes of the fore-wings furnished with a large, darkish, long, stigmatic cell, from and below which runs the strong cubital nervure which furcates at about two-thirds of its length. This furcation forms the subcubital nervure, and shows two forks, the outer of which runs to the margin, and the inner one nearly so, it being interrupted only by a curved inter-marginal vein. The lower wings are very delicate, and the neuration faint and difficult to trace.

Colour of the body shining pitchy-black, except the fore-edge of the pronotum which is rufous yellow. The underside also is black except the three last abdominal segments, the legs and the cauda, which are feruginous yellow. Membrane of the wings fuscous. Antennæ fuscous, except the two apical joints which with the tarsi are black.

This insect attacks the mango (*Mangifera indica*) and causes the terminal shoots of the tree to assume the form of imbricated pseudo-cones of a bright green or yellow colour. When cut open they show a central pillar, from which septa or curved walls proceed and form chambers which appear to have free communication one with the other. I could find no external openings to the two cones submitted to my inspection,

(1) A note on this species appeared on page 13 of No. 1 of this volume. The insect damages mango trees in Dehra Dun, North-Western Provinces, by aborting the young shoots. The specimens were furnished by the Director of the Forest School. Mr. Buckton writes that it may prove hereafter necessary to erect a new genus for the reception of this species; for the present, however, he includes it in the genus *Psylla*, to which it is most nearly related.

but I extracted several almost completely developed imagoes from the chambers, and also the exuviae from larvæ. Probably the above insects were hardly ready for exclusion, and hence the imperforated condition of the cones.

Some interest attaches to the circumstance that the Terebinthaciæ to which mango tree is referable are peculiarly open to the attacks of gall-making insects. We have numerous examples of Pemphiginæ amongst Aphides infesting the foliage of exotic species.

Size of insect $0\cdot14 \times 0\cdot08$ milimetres.

Wings 0·13.

Antennæ 0·04.

NOTE ON THE PESTS OF THE TEAK TREE.

By MAJOR C. T. BINGHAM.

At page 46, No. 2, Volume XVIII of the "Indian Forester," there is a note by Mr. J. Nisbet, Deputy Conservator of Forests, on the damage done to the teak plantations in the Pegu Circle by the larva of a moth.

This moth, called by Mr. Nisbet, "*Tortrix (Tectonæ?)*," does not, so far as I know, occur in Tenasserim. During the past three years, while on tour in the forests, I have made careful search, and been always on the look out, but have failed to find it. Quite recently also at my request Mr. P. W. Healy, Extra Assistant Conservator of Forests, went the round of the whole of the teak plantations, and over much of the natural forest in the Ataran valley, without coming across a single teak tree attacked by the pest.

As it was a matter of some importance to procure the moth and have it properly identified, on the 23rd April of this year I sent a servant, who has been used to collect insects for me, to Rangoon, and by the kind permission of Mr. Jellicoe, Deputy Conservator of Forests, in charge of the Rangoon Forest Division, he was enabled to proceed to the teak plantations in the Magayi reserve, where the plague of caterpillars destructive to the leaves of the teak had set in. This plague, I believe, occurs annually in some portion or another of the Rangoon Division.

Some 50 or 60 larvae were procured by my man, who returned on the 30th.

Unfortunately I had been obliged a day or two earlier to go out into the district, and I did not return till the 6th May.

On examining the box containing the caterpillars, which had, according to directions I had left, been looked to daily and fed with fresh teak leaves, I found that the majority had not only pupated, but that a good number of the moths even had issued. Luckily, however, there were still some 12 or 15 remaining in the larval state.

The moths I found were of two species.

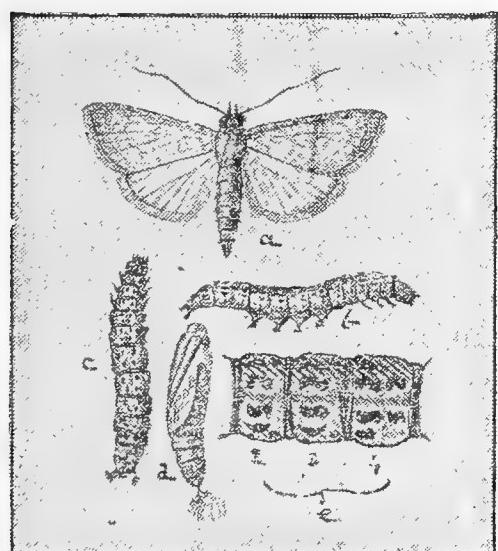
One, a soft dark robust-bodied moth, with an expanse of 1 3 inches,



has been identified by Mr. Cotes as a *Noctues* moth of the family *Hyblæidæ*,

species *Hyblaea puera* Cramer. On the *upper side*, the ground colour of the fore-wing is ashy grey with a tinge of yellow, shaded at the base of the wing on the disc, along the costa, and broadly along the outer margin with soft dark brown; hind-wing dark brown with an irregular band on the disc not reaching the costa, and a large squarish mark at the anal angle vermillion red. Cilia of the fore-wing dark brown, of hind-wing brown with a light wash of pink. *Underside*, both wings pale vermillion red turning at the base, along the costa and on the disc of the fore-wing to yellow; an irregular mark on the fore-wing and two spots at the anal angle of the hind-wing, with some indistinct shadings dark brown.

The larva measures a little over one inch in length. It is whitish yellow beneath, dusky greenish above. Along the middle of the back is a pale flesh-coloured stripe with darker smoky brown stripes one on each side, which latter are each outwardly margined by an indistinct and somewhat interrupted white line. Head dark brown; a few erect dark hairs scattered over each segment.



The second species, Mr. Cotes informs me, is new to the Indian Museum collection, but that it is undoubtedly one of the Pyrales and very close to *Paliga (Scopula) damastesalis* Walker.⁽¹⁾

The following is a brief description of the larva and moth.

Larva : length 0.7 to one inch. Colour pale sap-green; two lines of purplish spots along the middle of the back. Head yellow; a few pale erect hairs

scattered over each segment.

Moth : expanse 0.9 inches. *Upperside* pearly white with a slight creamy tinge; fore-wing marked along the costal and outer margins and across the disc with spots of red, forming on the last indistinct narrow red cross bands; hind-wing with the outer margin narrowly edged with the same colour. Cilia of the fore-wing alternately red and white; of the hind-wing pure white. *Underside* pearly white.

The larvae that had not pupated had all turned by the fifth day after my return. Both species seem to take the same length of time over their metamorphosis, the moths issuing from the 8th to the 11th day after pupation.

The *Hyblaea* formed a rather flimsy cocoon either in the corner of the box, or along the mid rib of a leaf, dragging the sides of the leaf slightly together with the web. The *Pyralis* invariably rolled itself up in the edge of the leaf, holding it in position by a few threads.

⁽¹⁾ The specimens have since been submitted to Colonel C. Swinhoe, who was kindly examined them and determines the species as *Paliga damastesalis* Walker—Ed.

My recollection (for I unfortunately have mislaid the notes I took) of the ravages of these caterpillars when I was in charge of the Rangoon Division, is that they appeared in the teak plantations on or about the 20th May, sometimes in almost incredible numbers. Their ravages were confined to certain areas, where they reappeared year after year stripping the young teak of their leaves with the rapidity almost of locusts, and hanging in thousands by webs to the branches of the trees.

It is quite possible that *Hyblaea puera* may, like the *Tortrix murinana* mentioned by Mr. Nisbet in paper above quoted, pupate among the dead leaves on the ground, but, if so, I should fancy few individuals could survive, for a plantation attacked by these pests is a wonderful scene of activity. Numbers of jungle fowl, ground thrushes (*Pitta*), and insectivorous birds of all kinds crowd to the spot to feed on the caterpillars.

The *Pyralis*, as I have already said, rolls up the edge of a leaf and is thus rendered less conspicuous and saved from enemies. It certainly occurs in far greater numbers than the *Hyblaea puera*.

MAULMAIN ;
18th June 1892.

MISCELLANEOUS NOTES.

In April 1892 some galls found upon spruce fir (*Abies Smithiana*)
 Galls on spruce fir. trees near Chakrata in the North-Western
 Himalayas, were sent to the Museum by the
 Director of the Dehra Dun Forest School. The galls were superficially
 very much like small fir cones. They were inhabited by aphids, which are
 believed to cause the abnormal growth by irritating the tissues of the
 shoot in feeding. The insect appears to be closely allied to the species
Chermes coccineus, Ratz., which attacks fir trees in Europe in a similar
 manner. The Museum does not possess specimens of the European form,
 so some of the Chakrata galls have been sent to Europe for comparison.

In an interesting communication received in May 1892, Mr. E. E.
 Notes from Ceylon. Green writes that an ant which has been
 identified as *Dorylus longicornis* sometimes attack potatoes (*Solanum tuberosum*) to such an extent in Ceylon as
 to make it impossible to grow this vegetable. Mr. Green found that the
 same ant also attacks the roots of other garden plants, working so insidiously that the damage usually remains undiscovered until it is too late
 to save the plant. Mr. Green suggests that the ant noticed on page 42
 of Volume II of these *Notes*, attacking potatoes in Burma, may perhaps
 have belonged to the same species. Mr. Green also forwards some scale
 insects (*Coccidæ*) found on Tasmanian apples which were being sold in
 Ceylon. The scale contained living eggs, which would, no doubt, in
 due course have hatched out producing active larvæ capable of establishing
 themselves in any place where they happened to light upon a suitable
 plant. As Mr. Green points out, the find is an interesting one as
 showing how easily insects of this kind may be introduced from enormous
 distances. The scale insect in question is likely to have been *Mytilaspis pomorum* Bouché, which often does much damage in orchards. As, however,
 the specimens of this species in the Museum collection are very poor
 ones, there is some little doubt about the identification.⁽¹⁾

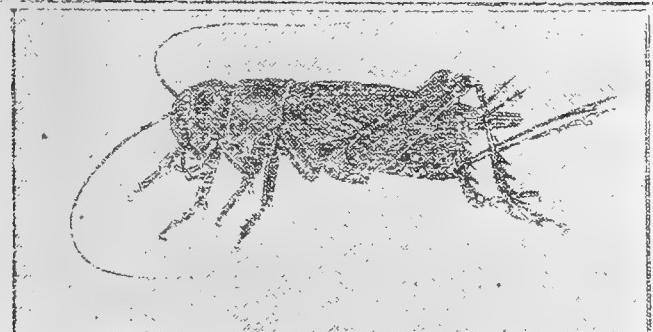
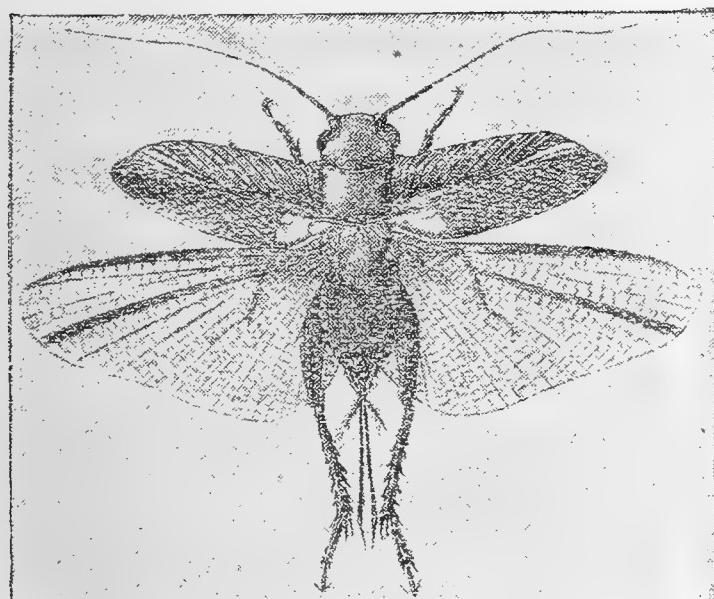
With regard to the identification of the Aphid noticed on page 46
 Mustard aphid. of Volume II of these *Notes* as very injurious
 to the mustard (*Brassica*) crop in Hooghly,
 Mr. G. B. Buckton, F.R.S., who has kindly examined the insect, writes

¹ The insect has since been kindly examined by Mr. W. M. Maskell, who confirms the identification, and notices that the species is one which attacks several trees in the temperate zones; it is specially common upon apple trees and hawthorn in New Zealand.

that, so far as could be made out from the specimens forwarded, the insect seems to be identical with the species *Aphis brassicæ* which attacks *Sinapis arvensis* and other field crops in England. It would be desirable to procure further specimens to enable the insect to be identified with certainty. It is likely to be the one noticed by Duthie and Fuller, in their *Field and Garden Crops*, as attacking *Brassica campestris* (rape) and its varieties in the North-West Provinces. The following is an extract from their valuable work (Part II, page 31) :—

"The outturn of rape is extremely precarious, or otherwise it would be much more generally grown as a sole crop than it is, since area for area the value of a crop of *sarson* would be considerably greater than that of a crop of wheat. It is, however, peculiarly liable to the attacks of a species of blight, and in damp seasons every plant in a field is not uncommonly covered with tiny insects (Aphides), which suck the sap from the flowering shoots and effectually prevent any seed from growing. Where holdings are large, as they are in the sub-Himalayan country, a cultivator can afford to risk the total loss of the crop on a part of his land, with the chance before him of handsome profits if the season is propitious. But in the crowded districts of the Doáb the total loss of a crop means such distress to the cultivator that he prefers to make a certainty of a moderate profit rather than run any risk in aiming at a large one. The cultivation of rape as a sole crop in some parts of the provinces, and as a subordinate crop in other parts, is therefore explained by a difference in the density of population."

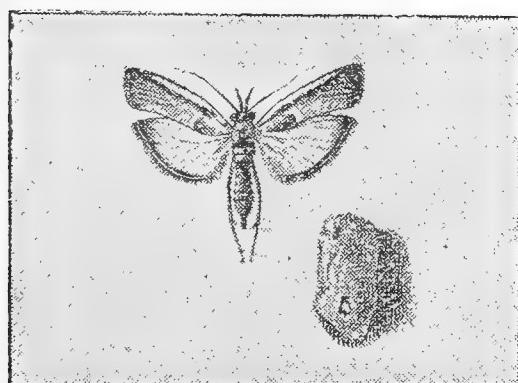
In March 1892 Mr. J. Mollison, Superintendent of Farms, Bombay Presidency, forwarded specimens of a cricket which had proved destructive to potato plants in Khandesh, by cutting through the stems near the surface of the ground. The insect was found to be identical with specimens in the



Museum collection which have been determined by Dr. Henri de Saussure as *Liogryllus bimaculatus* DeGeer (Gryllidæ), a species which has not previously been noticed as destructive in India. Crickets of this kind are very difficult to deal with; flooding the land to bring them to the surface, where the birds can get at them, may be useful in cases where it is practicable; while dressing the land with gas lime soot and such fertilisers as *kainit* might perhaps be worth trying, though there is little evidence to show that they do much good.

In April 1892 Mr. A. V. Knyvett forwarded specimens of a moth, the caterpillar of which had been noticed as attacking castor-oil plants (*Ricinus communis*) in the Sonthal Pergunnahs. The specimens were in too poor a state of preservation for satisfactory examination, but, as far as could be made out, they were identical with specimens in the Museum collection which have been determined as belonging to the species *Conogethes punctiferalis* Guén. The caterpillar attacks the seeds and is said to have done a large amount of damage.

In March 1892 Mr. J. Mollison, Superintendent of Farms, Bombay, forwarded pods of Bombay hemp (*Crotalaria juncea*) tunnelled by the larvæ of a micro-lepidopterous insect. Mr. Mollison wrote that the insect had been very destructive in Baroda in the months of October and November, a third



of the pods kept for seed being affected. When full-fed the caterpillars spun themselves up into little silken cocoons, which, in the case of the ones reared in the Museum, were attached to the sides of the box in which the pods were placed. It is probable, therefore, that the habit of the insect is to desert the pods before spinning its cocoon. Moths emerged in the early part of April; they prove to be Phycidæ, but the species is new to the Museum collection, so specimens have been sent to Europe for precise identification.⁽¹⁾

In April 1892 some cut worms and Elateridæ larvæ, said to have proved destructive to potato plants in Kalimpong, Darjeeling, were received from Babu N. G. Mukharji. The insects were too immature for precise identification, but the cut worms were likely to have belonged to the species *Agrotis suffusa* Fabr. (Noctues) a species which was reared on a previous occasion in the Museum from caterpillars which proved destructive to potato plants in Kurseong. Kerosene emulsion was tried by Babu Mukharji, but the results, though encouraging, do not seem to have been at all conclusive. At the time that the emulsion was applied very few stems had been cut, though numerous grubs were to be found at the foot of each plant; after the emulsion had been applied, Babu Mukharji found that more

⁽¹⁾ The insect has since been kindly examined by the well known entomologist Mr. F. Moore, who identifies it as the species *Mellia zinckenella* (*Phycis zinckenella* Trict.) a not uncommon Phycid in Europe, India, and Ceylon.

than three-fourths of the plants died, but the grubs disappeared and the plants that remained seemed vigorous; so it is possible that the plants which died were merely those which had previously been injured by the grubs. It should be noticed, however, that Kerosene emulsion is not usually recommended for use against cut worms or Elateridæ larvæ in other parts of the world. In India hand-picking seems to be the only method that has hitherto been adopted for fighting these classes of insects, which live chiefly underground. In England ploughing gas lime into the land when the crop is off the ground has been recommended against similar insects, while such dressings as soot, guano, nitrate of soda, salt, and rape dust are all said to be useful.

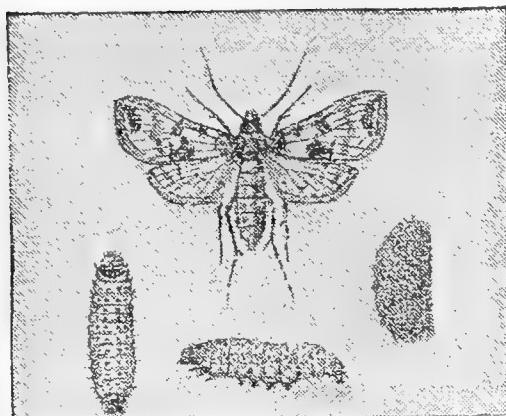
In January 1892 a few specimens of the white wax insect *Ceroplastes ceriferus* Anderson, were forwarded to the Museum by Mr. J. Deveria, who wrote that it was plentiful on trees in Purulia. This is of interest in case more specimens of the insect are wanted in connection with the inquiry dealt with in Volume II, No. 3, of these *Notes*.

In March 1892 specimens of the rice sapper (*Leptocoris acuta* Thunb.) were forwarded to the Museum by Major Yerbury from Trincomali in Ceylon, where the insect was said to have proved destructive to the rice crop.

In April 1892 an insect was received through the kindness of Messrs. Barry & Co., with the information that it was a supposed enemy to the tea plant. The insect proves to be one of the Curculionidæ beetles. It is identical with a specimen in the Museum collection which has been determined as *Astycus chrysochlorus* Wied. It had been forwarded by Mr. John Leekie of Cachar, who was of opinion that it was responsible for the stripping of the young leaves off the tea shoots, noticed in several parts of the garden. The insect is not unlikely to feed on the young tea shoots, but it has not previously been reported in this connection, and is not expected to occasion much injury.

The Brinjal (*Solanum Melongena*) fruit, which is brought to the Calcutta market, is sometimes found to be attacked by the caterpillar of a microlepidopterous insect which bores into it much in the way that the caterpillar of the coddling moth bores into apples. Caterpillars of the brinjal borer obtained on the 26th April 1892 began to emerge, in the Museum, as

moths on the 5th of May.



In the case of one at least of the specimens, the caterpillar, when full fed, seems to have deserted the fruit and spun itself up into a very slight silken cocoon upon the side of the cage, and this is likely to be the general habit of the insect, though it would be as well to observe further specimens before concluding that the habit is an invariable one. The moth proves to be identical with some

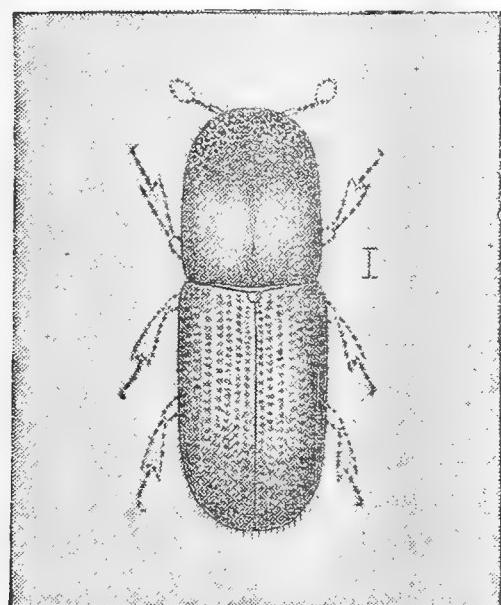
specimens in the Museum collection, which have been determined by Colonel Swinhoe as *Lencinodes orbonalis* Guén. (Pyrales). This species has been recorded as occurring in all parts of Northern India; also in Burma, Ceylon, the Andaman Islands, Java, and South Africa.

In July 1891 some Orthopterous insects were forwarded to the Museum by the Deputy Commissioner of Orthoptera in Shahpur. the Shahpur District, Punjab. They were

of two kinds known respectively as *Toka* and *Tiridda*. Both species were said to be exceptionally numerous in Shahpur, where they had done considerable damage to the young summer crops. The *Toka* insect proved to be a cricket allied to the genus *Gryllodes*, but hitherto unnamed in the Museum collection. It has, therefore, been sent to Europe for identification. According to the reports furnished by the district officers, this insect sometimes does much damage to young bajra (*Pennisetum typhoideum*), jowar (*Sorghum vulgare*), cotton (*Gossypium herbaceum*) and other crops, both in Shahpur and also in Hissar where it is known by the same name. It appears in the latter part of April. During the day time it generally lies hidden in the ground, but in the cool of the evening it comes out and feeds upon the young plants, but does little damage after the crop is four or five inches in height. It disappears in the latter part of the rainy season. With regard to the life history of crickets of this kind little has yet been observed in India, but in the case of allied species in the United States, according to Comstock (*Introduction to Entomology*) the eggs are usually laid in the ground in autumn. They hatch in the following spring, and the insects mostly die off on the approach of winter. With regard to remedies, too little is yet known to enable any very definite treatment to be recommended, but breaking up the ground in the cold weather would seem likely to be useful, as it would expose the eggs, both to their natural enemies the birds, and also to the extremes of temperature, which would probably be unfavourable to hatching. The *Tiridda* insect proves to be an Acridid grasshopper of the genus *Chrotogonus*, which has been referred to on several occasions in these

Notes as a common pest to young indigo (*Indigofera tinctoria*) and other crops in various parts of India. Little is known of its habits, and no satisfactory means of dealing with it seems yet to have been recorded.

In the *Kew Bulletin* for April 1892 is an interesting note on the subject of the little Scolytid beetle *Xyleborus perforans* Wollaston which has recently been reported as attacking growing sugar-canies in the West Indies. The species was originally described by Wollaston from specimens found perforating the bungs of wine casks at Madeira. In South America it has been recorded as boring into rum casks, also as frequenting cane refuse and rotting vegetable matter, and as attracted by lights at night. In India it has been noticed as boring into beer casks.⁽¹⁾ The danger now is that it may take to attacking growing sugar-cane in India to a serious extent as it is said to have already done in the West Indies. With regard to remedies the Editors of the *Kew Bulletin* write :—



"There should be no difficulty experienced by intelligent planters in the West Indies in dealing with this cane-borer. The infested canes should be destroyed, either by burning or passing through the rollers of the cane mills. Care should be devoted to the selection of 'plant' canes, to ensure that they are free from the grubs and eggs of the beetle, and precautions should be taken to get rid of all the cane refuse in a decayed state in the neighbourhood of the cultivated fields. In other respects the same steps are necessary with this borer as have been found effective in the case of the moth borer. This latter has been known to attack sugar-canies at intervals for nearly sixty years,⁽²⁾ but its influence has been rendered comparatively harmless by the systematic destruction of infested canes, and by examining and dressing the 'plant' canes before they are put into the fields. These simple and effective methods are fortunately within the reach of every one."

⁽¹⁾ It was at first supposed to belong to the genus *Tomicus*, and the commissariat serjeants are said to have appropriately dubbed it "Tippling Tommy." In his report on Insects destructive to forests, Allahabad 1868, Mr. R. Thompson writes: "I believe this to be a species of *Tomicus*, a minute cylindrical species I have observed boring into beer and water casks; as they bore clean through the wood, the liquor may be seen jetting out at various points, and by the force of the discharge the little borers are thrown out with it."

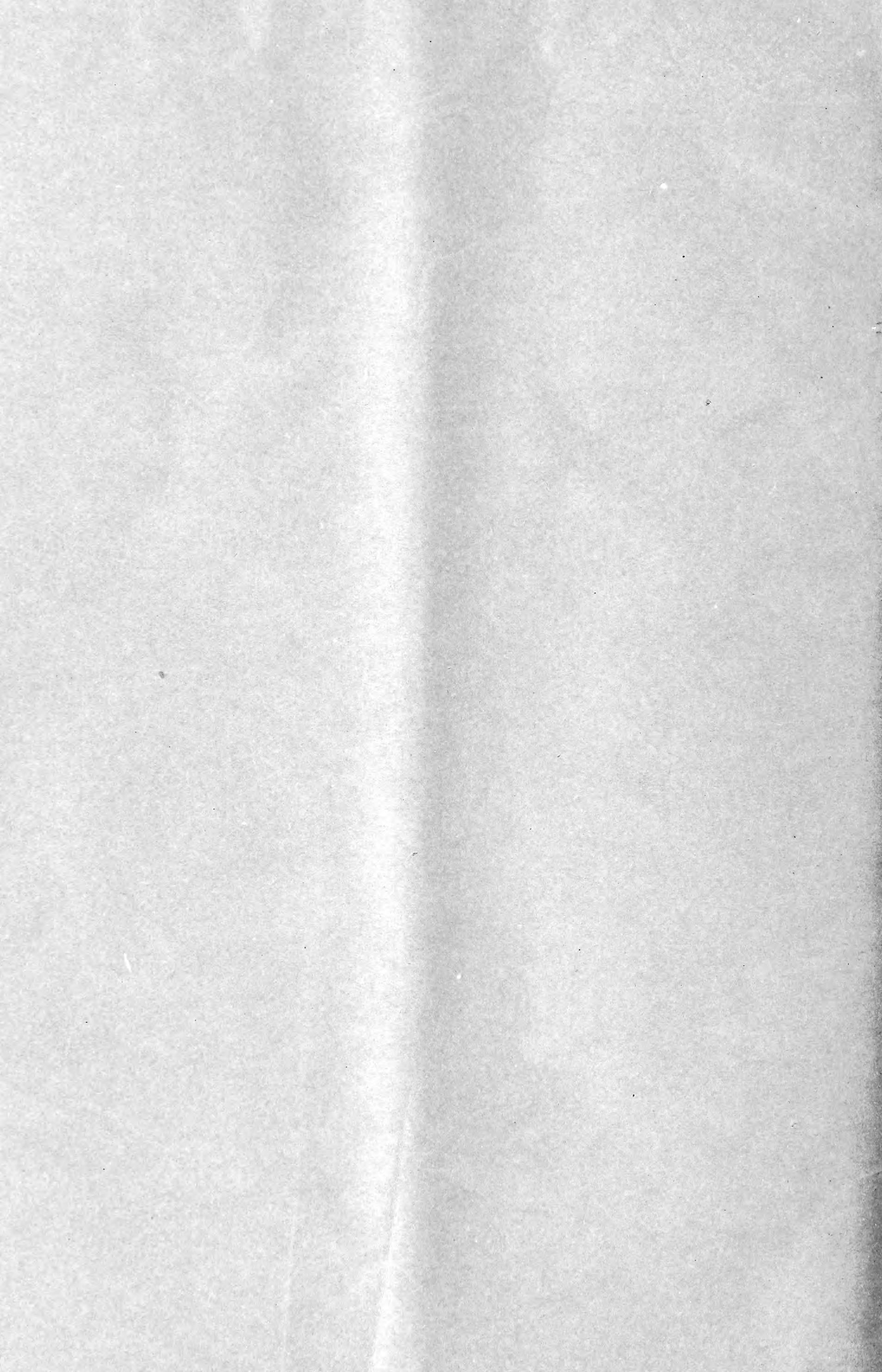
⁽²⁾ Vide the account of this insect given in Volume I, page 22, of these *Notes*.

The figure is drawn from a specimen from the West Indies presented to the Museum by Mr. W. F. H. Blandford. The length of the specimen is about two and a half millimetres. Its colour is light chestnut brown. The legs and antennæ in the figure are merely dotted in to give an idea of their probable shape, for the setting of the specimen does not permit of an accurate drawing being made of these appendages, and it has been thought best not to run the risk of damaging the specimen by disarranging it for the purpose as it is at present unique in the Museum collection. The markings shown in the figure on the prothorax and clytra will probably be sufficient to enable the insect to be recognized when met with in sugar-cane, but it should be noticed that there are a large number of very similar, though distinct insects, to be found boring into the bark of trees in India.

An interesting summary of what is known on the subject of the Fungoid disease *versus* goid disease (*Isaria densa* Link. = *Botrytis tenella* Saccardo) which attacks Melolonthini larvæ is given in the April number of the periodical *Insect Life*. The large amount of damage which is done by Melolonthini larvæ or "white grub" in India makes the question of the practicability of utilising this disease for destroying the pest, an important one, but the evidence at present available on the subject is very contradictory. According to M. Alfred Giard's paper in the *Comptes Rendus* of the 3rd August 1891, the spores retain their germinating powers for more than a year and the disease can be readily communicated not only to Melolonthini larvæ but also to other insects which live in a similar manner in damp situations. According, however, to M. Jean Dufour's paper in the *Chronique Agricole Viticole et Forestier du Canton du Vaux*, November 10th 1891, though the disease can be disseminated to a certain extent by infecting the soil either with artificial cultures or with fragments of diseased insects, the number of fresh grubs which take the disease is very limited.

E. C. COTES,
CALCUTTA,
25th June 1892.

Deputy Superintendent,
Indian Museum.



Indian Museum Notes

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